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ABSTRACT

Examples of energy education programs in selected elementary classrooms and schools and the resources to use to provide energy education are presented. Included are fourteen reports of energy education programs submitted by the teachers who are using them throughout the United States. It also contains an annotated bibliography of the listed resources which can be found in "Resources in Education" and are available through ERIC. (Author/SB)

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ENERGY EDUCATION PROGRAMS

ELEMENTARY SCHOOL PROGRAMS AND RESOURCES

Compiled by

Herbert L. Coon
and
John F. Disinger

ERIC Clearinghouse for Science, Mathematics
and Environmental Education
The Ohio State University
College of Education and
School of Natural Resources
1200 Chambers Road, 3rd Floor
Columbus, Ohio 43212

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PREFACE

This bulletin contains examples of energy education occurring in selected elementary classrooms and/or schools and resources to use to provide energy education.

The American tradition of state and local control of education results in a tremendous range and variety of curriculum developments concerned with energy. Some state departments of education have provided good teaching materials and good in-service education; most have provided little. Some city school systems and school building principals have been quite successful in incorporating substantial amounts of energy education into their schools and classrooms. But the prime determinants of whether energy education is included in a teacher's program are the knowledge, commitment, enthusiasm, and skill of the individual teacher.

The teachers who have submitted the reports that follow are doing in the judgment of their principals, supervisors, state department consultants, or others, a good job with energy education in their classrooms. Neither the teachers nor the compilers of this bulletin are presumptuous enough to suggest that the examples which follow are the "best" or the only ones which might be found. But the ERIC Clearinghouse for Science, Mathematics, and Environmental Education believes that the examples can be useful to persons who are searching for school systems, schools, principals, and especially classroom teachers who are willing to share their ideas about energy education.

The ERIC system receives many documents related to energy education. The resources listed are among those announced in Resources in Education and available through the ERIC Document Reproduction Service. An ERIC search or one of the bibliographies listed will provide additional teaching resources.

INTRODUCTION

Changing priorities are a fact of life for America's schools. It seems that every time the teacher looks beyond the confines of the immediate classroom, he or she is confronted with some different topic, some new "must teach" area, some additional objective for which he/she should facilitate learning--for the good of the school, of the student, of our society. At some times, these priorities are readily acceptable to school, student, society, and teacher; at other times, differences of opinion exist as to what in fact are appropriate priorities. In terms of content areas alone, the past 30 years have seen shifting priorities directed at science/aerospace education, environmental/ecological/conservation education, "back to the basics" --and most recently, energy education. It is understandable that the teacher may take the skeptic's view of such shifts in emphases. Teachers are still teachers, classrooms are still classrooms, kids are still kids. Likewise, society is still society--but it changes, in terms of priorities, problems and perceptions much more rapidly than do teachers, schools, and children.

Since 1973, our societal view of energy has taken a series of abrupt shifts. It is not now, nor has it been, a matter of debate that ours is, and has been, an increasingly energy-dependent society. The shifts have been in terms of our perceptions of available supplies, most appropriate types and sources, fossil and non-fossil, alternative and appropriate technologies, and need for and procedures of conservation. The physical scientist is tempted to say "I told you so" with respect to society's recent recognition of diminishing supplies; the conservationist may tell us that his traditional view is newly legitimized; the economist tends to talk in terms of supply and demand and cost curves; the political scientist deals in the "art of the possible;" the environmentalist warns us of conflict between environmental values and energy alternatives.

The teacher is then confronted with the task of integrating a massive array of information--fact, opinion, perspective, priority--into some semblance of a teachable, and learnable package, whether it be a lesson, a unit, or a comprehensive program. It might be relatively easy, if there were agreement on what should be taught, what goals and objectives are desired, what society's long-term needs are, and what students really need to know about energy to function effectively as members of society now and in the future. The one conclusion about which there is consensus is that they need to know more, and it is in large part the responsibility of the schools to "teach it."

But there is no shortage of information. Much has been, and continues to be, written about energy, in terms of background information, and within the frameworks of program, curriculum, and lesson materials. Such information is available to the teacher who looks for it. The teacher's problem is really in terms of seeking, selecting, adapting, and packaging, keeping in mind the realities of his/her local situation --community, school, classroom, and children.

Few teachers will be in situations such that they will teach courses entitled "Energy"; few will be faced with the necessity, or the opportunity of developing an extended curriculum in this area. Most find themselves in situations where they must, or should, incorporate energy education into their ongoing programs--as a part of science, or of social studies, or of some other existing curriculum area, or as a short-term special study in a less structured school environment.

This bulletin presents examples of how some teachers, and schools, have incorporated energy education into ongoing programs. They are not presented as ideal models, either in the sense that all of the fruitful possibilities are advanced or in the sense that they will be appropriate in every classroom. But they do share two common denominators: they are all "real" and they all "work" in the situations in which they exist. It is likely that at least some of them will be adaptable to other classrooms in other locations.

Also in this bulletin is information concerning other curriculum program materials which the teacher may find useful. A number of sources of such materials is reported in the Bibliography section with brief annotations which are intended to provide enough information for the teacher to decide whether or not they will be useful in given situations. The teacher's task, then, becomes one of selection from a wealth of resources--and translating those raw materials into products appropriate to his/her learners.

EXAMPLES OF HOW ELEMENTARY TEACHERS

ARE INCLUDING ENERGY EDUCATION

IN THEIR PROGRAMS

1. Lindberg Elementary School
4133 Mt. Sebertine Avenue
San Diego CA 92111

Submitted by Irene Negus, Fifth and Sixth Grade Teacher

We need to steer the study of energy in elementary schools away from the simplistic practices of drowning students in purple duplicating ink or by having them fill in the blanks on mimeographed worksheets. Instead, teachers need to guide them to the creative problem-solving process.

The first step necessary in the study of energy is for students to understand what energy is, that energy is needed to make anything move or change, that energy is produced or released when fuels burn, and that all energy can be classified as kinetic or potential.

Another important factor which needs to be stressed is that electricity is a secondary form of energy coming from primary power sources such as coal, petroleum, natural gas, geothermal or nuclear energy.

In an effort to help students become aware of the world's energy needs, we studied charts and graphs which show international production and consumption of energy, and the relationship of these factors to the development of technology and national incomes around the world. Students soon become aware of the fact that the United States was consuming the major share of the world's supply of petroleum. My class studied the results of international relations with countries in the Middle East,; the devaluation of the American dollar abroad; and explored the effect industrial slowdowns due to energy shortages would have on our domestic affairs.

My class used a simulation game called "Energy X," which is put out by Ideal School Supply Company, Oak Lawn, Illinois, which was quite useful. The stated objectives of the simulation are as follows:

1. To create an awareness of need for intelligent use of energy in its many different forms.

2. To create an awareness of the concept of non-renewable resources.

3. To provide a classroom environment in which students learn relationships between locations of major resources, population, regional differences and related economic situations.

4. To provide students with experience in group dynamics different from that inherent in the typical classroom.

5. To encourage student awareness of their "real world" responsibility in dealing with the energy crisis.

The class soon concluded some regions of the United States were consumers of energy, while other regions were both consumers and producers.

We explored all types of possible power sources and their locations within the United States. As a teacher, I exercised great care not to make any value judgments as to the merits, or lack of merits, of each source. Students can make intelligent decisions when they have all the facts.

The class's final task was to construct a city appropriate for the year 2078. Students were told they had an exciting job as a futuristic city developer, who was to design and build an ideal city of the future. Their job was to decide where its people would live, work and play. Students had to explain how people would travel, and what kind of energy sources would be used. Our local Ecology Center was a good source for recycled materials which were used for our futuristic city.

Our study of energy was an ongoing project. Through the process, students learned a whole new vocabulary. They were given the opportunity to learn how to read electric and gas meters, and to figure the cost for their families' consumption of high and low energy users. Even passive students put their creative thinking into action; while dealing with the "real world" problem of finding alternative sources of energy, which the United States must have to maintain its position in world affairs.

2. Whiteman Elementary School

Denver CO 80220

Submitted by Sylvia Sather

Mrs. Sather states her position on energy education as follows:

> As adults we feel the impact of energy consumption and conservation. As adult educators we have an obligation to teach unbiased and objective information concerning energy and its effect on man. All children have the ability to understand these concepts if they are presented in a way that is more concrete in nature rather than one of abstract ideas.
>
> For years Americans have been the recipients of energy at a very low cost. Now they are faced with the reality of limited supplies and higher costs. The youth of today will become the real victims of an energy dilemma if they are not better informed. Hopefully, the coming of this "doomsday" can be retarded through education and its application to life. We can expect that energy alertness education will create more critical thinking and analysis in our children; as well as assisting them in becoming future problem solvers for energy.

It takes a unique and creative teacher to present energy concepts so that elementary children can internalize and understand the implications of energy consumption and conservation. Teachers have much abstract information to disseminate, the challenge is to break it down into bite-size pieces that children can use.

The following activities have been adapted so that they include Piagetian levels as well as right and left-brained teaching strategies. It is my philosophy that learning is enhanced and truly internalized when it is "put into the language and learning styles of the recipient" rather than that of the teacher.

The following are activities Mrs. Sather uses with her pupils:

1. Coal Deposits—Using chocolate chip cookies to represent the earth and coal deposits, have children count coal (chocolate chips) they see on top of cookie. (Graph results.) Have them dismantle the earth (cookie) into piles of coal deposits (chips) and earth (dough). Graph results—use divergent questioning techniques to discuss implications and applications to real earth and coal deposits.

2. Coal Consumption—Students can analyze effects of conservation as compared to unlimited consumption. Children eat chocolate chip cookies in usual manner, raise hands when all consumed and you tally on a graph. They consume second cookie only on a timed cue and tally that on graph. Results: Cookie (or coal) lasts longer if conserved.

3. Children read electric and gas meters for one week—chart results after week of total energy used.

4. Survey of home appliances—chart on bar graph.

5. The last three—Creative writing on the last three appliances you could part with if energy crunch were today.

6. Energy password with energy terms.

7. Children invent an insulation system to keep ice cold in a jar. Temperature is taken every 30 minutes. Graph results.

8. Lunchroom—Tally the number of milk cartons and plastic forks used in a day, week, etc. How can we recycle them?

9. Tally the number of toys that use energy other than mechanical energy. Other than electrical energy.

10. Use catalogs, old magazines—Cut and paste items that use electrical, gas and mechanical energy. Children are to print words with type of energy used with each machine.

11. Scrounge through trash—What materials are used in the making of these materials? What substitute containers could we use in a futuristic society?

Try these and other activities with your children—it's amazing what we can learn from them!

3. Heights Elementary School
7114 School Street
Fort Myers FL 33908

Submitted by Louise A. Dillard and Margie Snell

The program used in our school is designed to last nine weeks. It is divided into three modules, each containing nine units. Module A concerns itself with the nature of energy and its forms, man's need for energy and simple machines that the children can make to help them actually see energy work. Module B deals with biological energy systems, the environmental impact of energy usage and covers the formation of fossil fuels from prehistoric times to the present day. Module C, which we feel is the most exciting, covers how man uses his energy resources, some of the problems created by their shortage and steps we can take to reduce the demands on our resources.

Each module provides the students with excellent visuals and manipulatives. They are set up in learning center format to encourage individual exploration and discovery. Our community has developed a nature center and junior planetarium where students, teachers, and the public can visit for "hands-on" learning about energy. The Energy Management Center in Pasco County has designed and tested portable, miniature alternate energy devices which are available on loan for school use.

Through this positive approach to this ongoing energy problem, we hope to create a heightened awareness in the students and change in attitude toward their environment. We feel that by raising the students' consciousness and stimulating their interest, they can carry the message home which will in turn, create parent involvement. At the end of nine weeks, the parents will have an opportunity to evaluate the effectiveness of this new approach to an old problem. We look forward to their input and involvement in this exciting program.

4. Jefferson Elementary School
School District #25
3115 Pole Line Road-P.O. Box 1390
Pocatello ID 83201

Submitted by Lori Matteson

The purpose of the energy unit that I taught was to consider ways in which we, as individuals, could conserve energy.

We began the unit by exploring the reasons why it is possible to have an energy shortage. This included studying charts showing the yearly increases in energy consumption and looking at the fact that our heaviest dependencies are on non-renewable energy sources.

We researched ways people in our homes, schools and community were conserving energy. Each student planned methods he could use in conserving energy at home. With the help of the school principal and school district personnel, we learned what energy our school was using. Then, as a class activity, we planned ways in which our school could conserve more energy. We toured a local business and examined ways they were conserving energy. We discussed other means they could use in conserving energy.

The students researched various sources of energy. Each made a decision as to which source of energy he thought would be the most desirable and practical source for our energy needs both now and in the future. They based their decisions on availability, environmental impact, convenience, economics, and present technology.

The students' reaction to this unit was tremendous. They were anxious to share their awareness of energy conservation with their families as well as with other classes in our school. My students created skits, puppet plays, and short stories on energy conservation which they shared with other classes in our school. They also spearheaded a poster contest on energy conservation for the entire school. Winners were photographed along with their posters and their pictures were placed in the local newspaper. Many parents told me of their children's concern for conserving energy at home. I was acutely aware of their concern when one day I forgot to turn out the lights when I left the classroom.

Energy conservation became a vital part of my classroom's daily activities.

5. Jefferson Elementary School
School District #25
3115 Pole Line Road-P.O. Box 1390
Pocatello ID 83201

Submitted by Kevin Boos

The purpose of this lesson was to let the students find out there is more than one answer to solve the energy problems.

The first step was to introduce students to the problem. I had each student bring newspaper and magazine clippings about energy. We used these clippings to discuss energy issues, such as kinds of energy, where it comes from, the advantages and disadvantages to each source, and so forth.

For the last several years, Idaho Power Company has wanted to build a controversial coal-fired power plant. I invited an Idaho Power representative to tell the class why it should be built. I also had a lobbyist from the Idaho Conservation League tell why it should not be built.

Before the representative came, I had the class write down some questions they had to ask them. When the men arrived, each one spent about 8-10 minutes explaining their views. A student moderator then called on other students to ask questions. The question-and-answer period went on for 45 minutes. After the men left, the class talked about their feelings on what was discussed. Before going home, each student wrote Governor Evans a letter telling why the power plant should or should not be built. These were sent and we received a reply about a month later.

The student response was great. Some students had written up to two pages of questions to ask. The class voted to miss recess to have more time to ask questions. The reasons they gave in their letters for or against the power plant showed much thought. They wrote about having enough power for jobs when they grew up, of pollution, of some alternatives, and if more power would bring in more people, which many students did not favor.

I used members of the community (Idaho Power and Idaho Conservation League) for information. The local paper ran an article on the lesson.

6. Project SAVE
Arlington Woods School #99
5801 E. 30th Street
Indianapolis IN 46218
Jesse B. Lynch, Principal

Submitted by Fredonna Pennington

The school's SAVE program that began five years ago focused initially on general environmental education concerns. During the second year, the (E) in SAVE stood for "energy" with a concerted effort made during a one-month period to save energy in school and at home. A list of energy-saving suggestions compiled by eighth graders was sent home with each child. Later a checklist was sent home to see if suggestions had been followed and if they had helped the family conserve energy. The month-long focus on energy climaxed with SAVE Week and SAVE Day. On the final day each classroom displayed on a table or in a booth their room theme and/or projects concerning energy and its conservation.

During the 1977-78 energy crisis, a group of twelve eighth grade mathematics students became the school's "Energy Committee." This committee was responsible for reading the three school electric meters each day at the same time. These readings were reported each day to the principal who, in turn, reported them to the central school system office.

A representative of the Indianapolis Power and Light Company talked with seventh and eighth grade pupils about the school's electric bills, the energy used by various electric appliances, energy used in typical homes, and what students could do to reduce electrical bills. He also talked about the enormous amount of coal needed to produce our electricity.

Seventh and eighth grade students learned how to read home electric meters and took the registers removed from actual meters to third through sixth grade classrooms where they taught pupils how to read home electric meters.

The seventh and eighth graders had a mathematics assignment of reading their home electric meters at the same time each day for one week. When these readings were brought in at the end of the week, they used mathematical skills to find daily kilowatt-hours used and then the amount used for the week. Students were also involved in deciding why certain days of the week showed increased use of electricity.

7. Washington County Elementary School
Springfield KY 40069
Mrs. Jean W. Boone, Principal

Submitted by Milton Wheeler

With aid and encouragement from Bernard Bourbeau, 4-H youth agent with the Washington County Cooperative Extension Service, Mr. Wheeler's sixth grade class became involved in a comprehensive unit entitled "Conserving Energy by Using Insulation." The unit developed by Mr. Wheeler included objectives, subject matter to be included, motivation suggestions, study activities in language arts, social studies, art, music, mathematics, career education, and science, and evaluation questions. Special area teachers were involved in the study and lesson plans were developed to incorporate their expertise.

The class, with access to the University of Kentucky computers arranged by the 4-H agent, undertook the job of determining the amount of energy lost in heating and cooling in the Washington County Elementary School as compared to two other schools in the county. Blueprints of the buildings were obtained and used to measure windows, doors, length and width of the building, basement, and roof area. The class also checked the type and amount of insulation used in each building. After all the data were collected, the class fed the information into the computer which returned a printout indicating the school's heat loss as 12 percent, which was lower than that of the other two schools.

As the class studied heat loss and energy costs in their building, parents became interested in what they were doing. Some parents wanted their homes checked to see what they could save if they put in insulation or added to what they had. Class members wrote letters to various insulation companies to find out the types of insulation and the R value needed for walls and ceilings of each home.

Each student measured their home, measured windows and doors, determined the types of windows and doors used, and the extent of present insulation in the home.

After information on each home had been collected, a computer terminal from the University of Kentucky was brought to the school. Each student fed data regarding his home into the computer and received a printout telling the homeowner how much insulation was recommended to maximize savings in his particular home.

The project was judged to be eminently successful when 26 parents of the 31 children who participated in the project had more insulation added to their homes or had their homes completely insulated.

8. Pontiac Michigan Public Schools
Office of Energy Education
86 Parkhurst
Pontiac MI 48058

Submitted by Bea Wallace, Director

1. Sixth Grade Program

Sixth grade pupils are involved in an energy activity entitled "A Ray of Sun." In this unit pupils will begin to recognize the basic technology of solar energy collection, and should be able to determine the benefits and some of the problems associated with use of this energy resource.

The group under the supervision of the teacher will be able to design and build a solar food dryer for the purpose of drying different foods and understanding this food preservation process. Other teaching ideas are also included in the four-page leaflet given to teachers.

Teachers report that this is a high interest topic that can relate to development of several basic skills as well as energy conservation understanding.

Third and fourth grade pupils make use of "Energy Ant" materials while selected fifth grade students participate in school clubs that undertake energy-related projects.

2. Seventh Grade Program

Seventh grade students are involved in an energy activity entitled "The Accountant." In this activity, youngsters will begin to gain some understanding about cost analysis in the operation of schools and homes. Data collection and its analysis in the process objective with many math and economic skills being utilized.

Students obtain a copy of the local bills for their school from the central administrative business office. Measurement of the building, recording the number of students, and computing the operational cost per foot and per student for a given month are some of the basic skill activities in this unit. Furthermore, a homework assignment requests parents to conduct a similar accounting of their cost for energy. Comparisons can be made between school and home costs.

Under development is an activity unit that will suggest to teachers how seventh grade students might be involved in a study of school bus transportation costs.

9. Craven Crawford Elementary School
195 Blackberry Road
Liverpool NY 13088
Dr. Robert S. Welcher, Principal

Submitted by Dr. Bessie Cooper Noble

The fourth grade unit on the Environment and Energy included the following goals:

-to identify sources of energy
-to compile and analyze statistical data regarding use of energy in homes, community, nation and world
-to explore present and future sources of energy
-to stimulate advanced study of energy
-to acquaint pupils with theories of persons such as Aristotle and Einstein who have worked on energy-related questions
-to develop knowledge about energy of the human body
-to increase awareness of world-wide interdependence

Pupils in the class conducted an energy survey during which they examined energy usage in their home and in the homes of neighbors who lived on both sides of them. What appliances did they own and use? What automobiles and other vehicles? How was the home heated? Comments of persons interviewed were solicited. Survey data collected pointed up the tremendous use of various kinds of energy in a well-to-do Upstate New York village. Many aspects of the energy situation such as reliance on oil and gas as fuel sources and the importance of conservation were studied as a result of the survey.

Interviews with parents and neighbors provided good opportunities to develop both oral and written language skills as well as the ability to contact others in a meaningful manner.

Parents and other resource persons who possessed special skills or information on energy matters were invited to come to the class and share their expertise with pupils. Out of these contacts, several pupils pursued experimental projects with new devices in the field of energy.

10. Nate Perry Elementary School
Buckley Road
Liverpool NY 13088

Submitted by Shaila Cole, Second Level Teacher

Our second grade fuel's class deals with what fuels are and how they originate.

To start the unit we discuss green plants and how they use energy from the sun to make food. During these discussions the fact that carbon is in foods made by plants is emphasized. At this point the children start making a bulletin board showing plants growing in sunshine.

The first fuel we deal with is wood. When we burn wood the carbon burns and gives off heat and light. From wood we go to charcoal and how it is made. The children enjoy drawing with charcoal and it gives them an opportunity to examine it closely.

The next step is dealing with plant and animal life millions of years ago. We make the next section of the bulletin board showing water full of dead plants. After talking about how this material piles up for millions of years we tack up brown and gray strips of paper to put over the accumulated materials. This shows how the sand and mud covered the dead plants that once grew in sunlight and contain carbon. The last strip of paper the children tack up is black showing the dead plants have now turned into coal.

The same procedure is followed in the development of oil. The only difference in the pond is the accumulation of dead animals instead of plants. The strips to represent sand and mud show the pressure and the last black strip over the animals shows the oil.

Next, the class deals with porous and non-porous rock and how oil is found in porous rock. To do this we put drops of water on glass and sandstone to illustrate the point.

To show that carbon is in things that burn we hold a spoon over a flame and then wipe off the black with cotton to show the carbon.

We talk about coal and oil being important in our daily lives--heating homes and industry. Then we go into mining for coal briefly and drill for oil. The children draw wells to put over our pond that contains oil. The children also enjoy making a model of an oil well after we have talked about the natural gas and water that are also found in oil wells.

During the unit I try to emphasize the importance of fuels and how it is getting harder and harder to find them. We talk briefly of new sources of energy such as solar energy and some kind that they may grow up and invent.

To end the unit the class presents what they have learned to the other second grade classes. They do this via the bulletin board display and showing their experiments.

11. Indian Hills Elementary Schools
6150 Drake Road
Cincinnati OH 45243

Submitted by Robert C. Terwillegar, Elementary Science Coordinator

One way to help children learn about and compare various energy sources is through a sorting exercise. Cards are prepared for each energy source. One side has the title and a description; the other lists some advantages and disadvantages. The sources we have prepared cards for are: coal, fission (breeder), fission (burner), fuel cells, fusion, geothermal, hydro, hydrogen, MHD, natural gas, oil, oil shale, radiant (solar), tar sand, thermal gradient, tides, trash (burning), waste (methane), wave action, wind, and wood. We duplicate the cards on xerox and laminate them.

The class is divided into small groups, each with a set of cards. The children, teacher directed or self-directing, sort the cards many ways; familiar vs. unfamiliar sources, those most used, those little used, only experimental sources, sources with the greatest future potential, polluting sources vs. non-polluting, exhaustible vs. permanent.

We also use a check sheet to keep track of the selections. By examining the listings we can compare and see that the currently most-used sources are in short supply and cause pollution. Some lesser-used alternatives seem to be inexhaustible and non-polluting. The whole exercise leads to questions being raised, reports chosen or assigned, and letters written to seek answers to specific questions.

Depending on the reading level of the cards and how this activity is presented, the children enjoy this way of learning about energy alternatives. As they sort the cards, they raise many questions. The answering of these questions can lead to many projects and activities. Besides the reports and letters, we have experiments with solar cookers, solar house models, steam engines, insulation, and others as an outgrowth of the cards.

Many of our activities are designed to involve parents and other family members. We capture their attention by encouraging the students to take interesting information and surprising facts home. We give a pre-test and use other questions such as: How much of the energy used by gas stoves goes for the pilot light? (10%? 25%? 50%?) Many people are astonished that it is 50 percent. Many of these items are found in material from industry or the government. The children also use facts like these on posters around the school.

Parents are also involved in a survey that the children take of their home and family energy use. The survey we use was published in the 1977 Energy Watch Calendar put out by the Oregon State Department of Energy. The students use a form to record size of house, insulation,

appliances, vehicles, members of family, travel, etc. At school we use tables to convert their answers to energy use units. We graph these individually against the world and Oregón use in 1975. Most of our children find that their use is many times the world average of 12 and double or triple the Oregon use of 100. We all find that items like air travel, color TV, automatic defrost refrigerators, parents who travel make big differences in a single class.

One of our final activities is a historical perspective. We list energy-consuming items we would not want to be without. Then we check the ones our parents would have had. This leads to a discussion of change and values. When we check the ones our grandparents would have had, we really see how much more dependent we are on some sources of energy. We try to speculate what our grandchildren would have on a similar list. This leads to predicting the future.

Preparatory to predicting for ourselves we read what some others have said. The March 23, 1970 Jr. Scholastic presents some predictions based on an ultra mechanized, energy consumptive, urban environment. One article from that "Scholastic" is a future story by Isaac Asimov written in 1951. In 1977 Mr. Asimov wrote another piece published in Time and condensed in the Reader's Digest that portrayed a future without much energy. The fact that the same person wrote both interests the children. We can discuss what might have changed his views.

Each child writes a prediction as he or she sees it. It can be narrative, descriptive, or in any other form. They are encouraged to pick a time in the future and state a date. If they assume we have solved the energy problems, their prediction should indicate how. They might assume we have not solved some major problem; i.e., radioactive waste; What then? Some predictions are realistic, some fanciful. Many are imaginative, most are optimistic.

12. Worthington Hills Elementary School
1221 Candlewood Drive
Worthington OH 43085

Submitted by Donna M. Kelley, Primary Grade Teacher

Energy, fossil fuels, stripmining and electricity are just a few of the words being frequently used by my first and second graders this year. In October I began to use a packet of energy activities which I had compiled and developed last summer at Ohio State's Energy Workshop held at Lake Erie. The activities were designed to be used over a full school year with students of varying ability levels in the first and second grades. I started with developing the idea of what energy is, what some of its sources are, and how we use it. I used a lot of filmstrips, pictures, books, transparencies and group discussions to develop the basic concepts. A bulletin board featured the sun as the source of all energy.

I also displayed pictures of my experiences at the workshop. Ohio State has a short film which highlights different aspects of the workshop and since I'm in it, I showed it to my class. Of course, they loved seeing their teacher in a movie! I think what impressed them most was, as one little boy put it, "You had to go away and learn all about energy so you could teach us about it this year." As every teacher knows, if you're enthusiastic and think a topic is important, the children will respond similarly, at least at this age. What can be more important than exposing children to a subject that is having such a big effect on their lives now and will be of even bigger concern in their futures! I've been amazed at their interest in this topic and the depth of understanding some of the children have attained.

These little people are doers, so they've cut pictures from magazines of things that use energy, played energy games, have written creative stories, have drawn pictures and made charts. I feel we've only touched upon the subject, so we'll be concentrating upon more about energy sources and energy conservation during the next few months. Since writing skills and beginning research skills have increased, many will be able to do some reports. We'll take an energy tour of our school building, have some resource people in, visit the coal mine at The Center of Science and Industry, make pinwheels, and do other energy-related activities.

I think it's always a good idea to keep parents informed about classroom activities and specific areas of study, so I sent out a newsletter telling them that we would be studying energy throughout the year and that they might be called upon to help with some "homework" on the topic. The children and their parents have made lists of the things that use energy in their homes. They then noted which items require the most energy and discussed ways they could begin cutting down on energy consumption. Many parents have commented that they've enjoyed doing these assignments and like getting involved with what their children are learning. They've all become much more aware of the whole subject. It's a little hard to be unaware when you're practically walking around in the dark at home because there's this little person going around flipping off lights constantly. The mother who related this to me was smiling (thank goodness). Parents often send in articles on energy from magazines and newspapers.

In science and social studies at the primary level, we're as concerned about the learning process as with what is being learned, and the study of energy has provided us with many exciting learning experiences.

13. Upper Perkiomen Middle School
Jefferson Street
East Greenville PA 18041

Submitted by Sandra Bahorik—Leader "Project Impact"

"Project Impact" was primarily concerned with disseminating basic knowledge of energy, economics, and environment (and their interrelationships) to 55 fifth-grade students who would, in turn, disseminate their knowledge to other middle school students and the community. As a result of acquiring some basic knowledge of E3, it was hoped those involved would also develop a local concern for the need to conserve energy.

Many methods were used to achieve effective awareness of E3 concerns and their interrelationships. Students established an E3 resource center in which student research was conducted. They viewed films, filmstrips and videotapes. Students completed various empirical activities both in the classroom and outside; used textbooks; took numerous field trips, including some to businesses within our community; invited and listened to guest speakers from the community; kept daily logs of activities; and studied school and home energy consumption resulting in development and practice of personal conservation strategies.

Community and school awareness of E3 interrelationships was also of importance to "Project Impact." This was achieved via public meetings, hallway displays, local newspaper coverage; the "Project Impact" resource room open to both the community and the middle school; a debate between fifth and seventh grade students (videotaped for other classes to use); an open door policy to visit our class (many students and parents did); a school-wide "Sunday" contest; and "The Energy Express."

The main focus of Project Impact's community and school awareness drive was the newsletter "The Energy Express." Written and edited by children, its goal was to help others learn what the children had already learned. Three issues were printed and sent home with middle school students. A true highlight of the year was a letter received from the U.S. Department of Energy concerning the newsletter stating:

> The energy awareness of the students involved in this project is gratifying. One of the greatest challenges confronting the Administration is to raise the energy consciousness of Americans. Creative efforts such as "The Energy Express" have incalcuable remifying effects.

Throughout the entire project, the students' enthusiasm never waned. The project was action-oriented, thus keeping their attention and allowing the students to use their emerging peer values in cooperative group work that encouraged self direction and independence in learning. The

subject matter was directed toward a tangible goal (such as saving fuel, saving money, teaching others, writing articles). In this way, the body of knowledge was worth learning because it was relative to the students' lives, the students' community. This point is a significant one, because as a result, the students were eager to learn and eager to discuss and, at times, debate what they learned. The result was, of course, true learning as evidenced by test results, parent comments, overt behavior and, hopefully, long-term acquisition of knowledge.

14. Thoreau Intermediate School
2505 Cedar Lane
Vienna VA 22180

Submitted by Mrs. Jean Mosteller

Energy was a basic topic in a semester of science work for an eighth grade class low in reading and mathematics skills. A reading teacher and a math/science teacher team taught the course; primary objectives were to raise mathematics and reading achievement levels by using science content.

Specific objectives were that the student be able to:

-define energy as ability to do work
-define kinetic and potential energy and to give examples of each
-name eight sources of energy and approximately what percent of our current needs each supplies
-explain the law of conservation of matter
-analyze patterns of human behavior and to relate them to the consumption of energy
-read an electric meter and an electric bill determining kilowatt-hours used during a given period, graphing that data, and determining average daily usage
-compare social costs and environmental impact of alternative energy sources for meeting and solving our energy crisis
-explain why we have an energy crisis
-improve reading skills of word attack, cause/effect patterns, main idea/detail, interpretation of graphic material
-improve in spelling ability
-improve vocabulary comprehension
-raise basic math computational skills levels
-apply knowledge gained to real life situations
-follow both oral and written instructions in sequence

Matter and energy were defined and sources of energy for both internal (nutritional) and external needs of man were introduced with ditto exercises. Each student was then given an assignment to become an "expert" in one field of energy. Several days of library research were allowed and each student wrote a formal report as well as making an oral presentation with student-made audiovisual aids.

Nutritional energy was then reviewed from seventh grade background where students had studied food webs and ecosystems in some detail. The calorie as a unit of food energy was discussed and an experiment involving burning a nut to raise water temperature was done in pairs. In order to introduce KWH, students mixed by hand and by electric mixer a packaged cake mix. While baking the cake, wattage was determined for mixer and oven, time appliances were operating was recorded, and KWH of electricity required to produce the cake figured. Final reward—eating the cake.

Students learned to read electric meters, to calculate KWH used daily, and they discussed various conditions which would affect amount of electricity used on any particular day. Students studied how to read a gas or electric bill and how to calculate bills for various KWH usage with a tiered rate structure, ignoring the fuel adjustment factor, though this was discussed as a major cause in the recent increase in prices for electrical and gas services. The quiz on this unit was to complete the card left by a meter reader unable to enter your house to read the meter.

Last spring following the energy expert reports, we were fortunate to be able to tour Terraset, Fairfax County's new underground solar-heated and solar-cooled elementary school. My reward for this came when the students were able to answer many of the questions asked of the guide by our assistant principal.

RESOURCES FOR ENERGY EDUCATION

The references annotated in this section contain learning activities and background information useful to elementary school teachers seeking to initiate energy education programs, or to improve existing ones.

All references are identified by ED numbers, which make it possible to locate them easily in the growing number of ERIC microfiche collections distributed widely throughout the United States. Each reference also indicates the cost of microfiche (MF) or hard copy (HC) if the reader wishes to order a personal or library copy from the ERIC Document Reproduction Service, P.O. Box 190, Arlington, Virginia 22210.

The resume for each reference is reproduced as reported in the appropriate monthly issue of Resources in Education, a publication of the Educational Resources Information Center (ERIC) aimed toward early identification and acquisition of reports of interest to the educational community.

ED 111 662 Fowler, John W. Energy-Environment Source Book. Volume 1: Energy, Society, and the Environment. Volume 2: Energy, Its Extraction, Conversion and Use. Washington, DC: National Science Teachers Association, 270p, 1975. (Available from—National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, DC 20009 - Stock Number 471-14692, $4.00 prepaid.) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This source book is written for teachers who wish to incorporate material on the complex subject of energy into their teaching. This work is divided into two volumes, each with numerous tables and figures, along with appendices containing a glossary, mathematics primer, heat engine descriptions, and nuclear energy discussion. Volume 1 (Energy, Society, and the Environment) deals with energy and its relationship with conservation, the environment, the economy, and strategies for energy conservation. In Volume 2 (Energy, Its Extraction, Conversion, and Use), topics discussed include the rate of energy consumption, future sources of energy, and the increased cost of energy.

ED 111 663 Mervine, Kathryn E. and Cawley, Rebecca E. Energy-Environment Materials Guide. Washington, DC: National Science Teachers Association, 68p, 1975. (Available from—National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, DC 20009 - Stock Number 471-14694, $2.00 prepaid.) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is a sampling of current energy literature. The references are divided into four separate categories, each directed for a specific audience: readings for teachers, readings for students (grades 8-10); readings for students (grades 5-9); and readings for students (grades K-6). Included in four appendices are guides for films and audio-visual

materials, curriculum materials, sources of information, and government documents.

ED 111 664 Smith, Stephen M., Ed. and Others. Energy-Environment Mini-Unit Guide. Washington, DC: National Science Teachers Association, 217p, 1975. (Available from--National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, DC 20009 - Stock Number 471-14696, $3.00 prepaid.) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This guide contains a collection of mini-units that provide materials for science and social studies teachers in grades K-12. These materials are intended to make teaching more interdisciplinary and to stimulate decision making in young children. Activities are sought that will enable students to: understand and use existing fundamental concepts in the energy-environment area; identify and evaluate personal and community practices, attitudes, and values related to energy-environment issues; and make effective decisions and/or define their views of appropriate actions on energy-environment issues.

ED 127 160 A Teacher's Introduction to Energy and Energy Conservation: Elementary. Columbus, OH: Battelle Memorial Institute, Center for Improved Education; Ohio State Department of Education, 93p, 1975. EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This document is intended to give the elementary school teacher background information and general suggestions for teaching units and correlated learning activities related to energy and energy conservation. Sections are directed to: A Problem Shared by All, Causes, What is Energy?, Energy Sources, Searching for Solutions, Conservation: An Ethic for Everyone, a glossary, and an extensive bibliography.

ED 129 602 Schwartz, Sid L., Ed. Energy Films Catalog. Energy Research and Development Administration, 1976. Oak Ridge, TN: Energy Research and Development Administration, 82p, 1976. EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This is the first edition of the Energy Research and Development Administration (ERDA) catalog of available motion picture films. One hundred and eighty-eight films, principally relating to energy, are briefly described and classified into three understanding levels. All films are loaned free, complete borrowing instructions and request forms are provided.

ED 130 833 Coon, Herbert L., and Alexander, Michele Y., Editors. Energy Investigations for the Classroom. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, 148p, 1976. (Available from SMEAC

Information Reference Center, 1200 Chambers Road, 3rd Floor, Columbus, OH 43212, $4.95). EDRS Price MF-$0.83 Plus Postage. HC-$7.35 Plus Postage.

This sourcebook, designed for use in grades K-12, contains energy teaching activities related to energy resources, energy production, distribution and use. Each activity has been classified by the editors according to the most appropriate grade level, subject matter, and energy concept involved. Subject areas are science, mathematics, social studies, language arts, and fine arts. This sourcebook draws heavily on ideas and factual materials found at the ERIC Clearinghouse for Science, Mathematics, and Environmental Education. The references cited in specific activities could be useful to persons interested in obtaining more activities and ideas related to energy. Many of the activities are interdisciplinary in nature and were developed or suggested by public school teachers.

ED 133 192 Energy Education Materials Inventory (e.e.m.i.). Part One: Print Materials. Portland: Energy and Man's Environment Inc., 102p, 1976. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is one of a six-part inventory of energy education materials. Included in this part is a listing of print materials, including the following: teacher's guides, curriculum guides, ditto masters, textbooks, pamphlets, and posters. For each of the materials listed, the following information is included when available: (1) Title; (2) Author; (3) Availability; (4) Cost; (5) Grade Level; (6) Related Materials; and (7) Evaluation of the Material.

ED 133 193 Energy Education Materials Inventory (e.e.m.i.). Part Two: Non-Print Materials, Part One. Portland: Energy and Man's Environment Inc., 75p, 1976. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is one of a six-part inventory of energy education materials. Included in this part is a listing of non-print materials including the following: films, filmstrips, slides, transparencies, audio-tapes, and records. For each of the materials listed, the following information is included when available: (1) Title; (2) Author; (3) Availability; (4) Cost; (5) Grade Level; (6) Related Materials; and (7) Evaluation of the material.

ED 133 194 Energy Education Materials Inventory (e.e.m.i.). Part Three: Non-Print Materials, Part Two: 16 mm Films. Portland: Energy and Man's Environment Inc., 66p, 1976. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is one of a six-part inventory of energy education materials. Included in this part is a listing of

16mm films. For each of the materials listed, the following information is included when available: (1) Title; (2) Author; (3) Availability; (4) Cost; (5) Grade Level; (6) Related Materials; and (7) Evaluation of the material.

ED 133 195 Energy Education Materials Inventory (e.e.m.i.). Part Four: Kits, Games & Miscellaneous Curricula. Portland: Energy and Man's Environment Inc., 25p, 1976. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is one of a six-part inventory of energy education materials. Included in this part is a listing of kits, games, and miscellaneous curricula. For each of the materials listed the following items are included when available: (1) Title; (2) Author; (3) Availability; (4) Cost; (5) Grade Level; (6) Related Materials; and (7) Evaluation of the material. Materials listed in this reference include both print and non-print items for teachers and students.

ED 133 196 Energy Education Materials Inventory (e.e.m.i.). Part Five: Reference Sources. Portland: Energy and Man's Environment Inc., 42p, 1976. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is one of a six-part inventory of energy education materials. Included in this part is a listing of bibliographies, computer sources of information, directories, educational programs, funded projects, periodicals, and journals. For each of the materials listed, the following information is included when available: (1) Title; (2) Author; (3) Availability; (4) Cost; (5) Grade Level; (6) Related Materials; and (7) Evaluation of the material.

ED 134 445 Magnoli, Michael A. and Wert, Jonathan M. A Composite of Energy Curriculum Guides and Enrichment Materials. Mobile, AL: Mobile County Public Schools, 16p, 1975. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This bibliography was prepared to provide a listing of a variety of curriculum materials, instructional materials, and references related to energy. Each entry includes: (1) Source, (2) Title, and (3) Comments on grade level and price when available. Materials are primarily selected for relevance to grades K-12.

ED 146 044 Bakke, Ruth. Energy Conservation Activity Packet, K-2. Des Moines: Iowa State Dept. of Public Instruction; Iowa State Energy Policy Council, 83p, 1977. (Available from—Iowa Energy Policy Council, State Capitol Complex, Des Moines, IA 50319 - $10.00 a set.) EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This book was developed in response to the concern for energy conservation. It contains activities that stress an energy

conservation ethic and includes many values clarification activities for grades K-2. The teacher is provided with some background information on energy, an extensive teacher's annotated bibliography, and a list of resources. The topic of energy is divided into concepts and objectives, with activities interspersed where appropriate. There are over 40 pages of ditto and transparency masters, two posters, and a game for the teacher's use. Also included is an evaluation sheet for the teacher to assess the activity packet.

ED 146 045 Bakke, Ruth. Energy Conservation Activity Packet, Grade 3. Des Moines: Iowa State Dept. of Public Instruction; Iowa State Energy Policy Council, 81p, 1977. (Available from—Iowa Energy Policy Council, State Capitol Complex, Des Moines, IA 50319 - $10.00 a set.) EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This activity packet for grade 3 is one of a series developed in response to the concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade three. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with ditto and transparency master pages to use in the classroom. An evaluation sheet and a list of resources are also a part of this activity packet.

ED 146 046 Bakke, Ruth. Energy Conservation Activity Packet, Grade 4. Des Moines: Iowa State Dept. of Public Instruction; Iowa State Energy Policy Council, 102p, 1977. (Available from—Iowa Energy Policy Council, State Capitol Complex, Des Moines, IA 50319 - $10.00 a set.) EDRS Price MF-$0.83. HC-$6.01 Plus Postage.

This activity packet for grade 4 is one of a series developed in response to the concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade four. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Part one is concerned with energy conversion and part two with energy production and use. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with pages for duplication. An evaluation form and a list of resources are also a part of this activity packet.

ED 146 047 Bakke, Ruth. Energy Conservation Activity Packet, Grade 5. Des Moines: Iowa State Dept. of Public Instruction; Iowa State Energy Policy Council, 94p, 1977. (Available from—Iowa Energy Policy Council, State Capitol Complex, Des Moines, IA 50319 - $10.00 a set.) EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This activity packet for grade 5 is one of a series developed in response to concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade five. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Part one is concerned with fossil fuels and part two with the history of energy in Iowa. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with ditto and transparency master pages to use in the classroom. An evaluation sheet and a listing of resources are also a part of this activity packet.

ED 146 048 Bakke, Ruth. Energy Conservation Activity Packet, Grade 6. Des Moines: Iowa State Dept. of Public Instruction; Iowa State Energy Policy Council, 102p, 1977. (Available from— Iowa Energy Policy Council, State Capitol Complex, Des Moines, IA 50319 - $10.00 a set.) EDRS Price MF-$0.83. HC-$6.01 Plus Postage.

This activity packet for grade 6 is one of a series developed in response to the concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade six. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Part one is concerned with the limits of energy sources and part two with alternative energy sources. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with ditto and transparency master pages for duplication. An evaluation sheet and a listing of resources are also a part of this activity packet.

ED 147 217 Allen, Rodney F., Ed. and LaHart, David E., Ed. Sample Energy Conservation Education Activities for Elementary School Students. Florida State University, Tallahassee: Palm Beach County Board of Public Instruction, West Palm Beach, FL, 59p, 1977. EDRS Price MF-$0.83. HC-$3.50 Plus Postage.

The booklet contains learning activities for introducing energy and conservation concepts into the existing elementary school curriculum. The activities were developed by Palm Beach County teachers during a one-week workshop. A framework of ideas is divided into three functional categories: universe of energy, living systems and energy, and social systems and energy. The first two categories outline scientific concepts fundamental to an understanding of basic energy ideas and energy flow models of which human beings are a part. The third category sets forth basic concepts in social systems, including governmental, economic, and moral systems, the understanding of which is vital in making decisions affecting production, distribution, and consumption of energy resources. Sixteen

sample lessons are provided for grades 1-3 and 19 for grades 1-6. Activity ideas focus on topics such as the sun as a source of energy, fossil energy, and conservation of scarce resources. The majority of activities consists of scientific experiments; other activities include puzzles, drawing exercises, and cut and paste activities. The activities are suggestive, rather than prescriptive; teachers are encouraged to adapt and expand the activities.

ED 149 987 Environmental Education, Values for the Future: Energy. Grades 6-8. Springfield: Illinois State Office of Education, 47p, 1977. EDRS Price MF-$0.83. HC-$2.06 Plus Postage.

This booklet on energy is one of a series in environmental education for grades K-12. The activities contained within address the effect of culture in determining energy needs, energy loss, and forms of energy. Four basic concepts are listed, along with behavioral objectives, subject areas, key words, and definitions for each. The three activity options associated with each concept include the following information: materials and resources, procedures, discussion questions, further activities, and sample worksheets. These interdisciplinary activities are designed for students in grades 6-8.

ED 152 529 Science Activities in Energy: Chemical Energy. California University, Berkeley, Lawrence Hall of Science; Oak Ridge Associated Universities, TN, 30p, 1977. EDRS Price MF-$0.83. HC-$2.06 Plus Postage.

Presented is a science activities in energy package which includes 15 activities relating to chemical energy. Activities are simple, concrete experiments for fourth, fifth, and sixth grades which illustrate principles and problems relating to energy. Each activity is outlined on a single card which is introduced by a question. A teacher's supplement is included.

ED 152 530 Science Activities in Energy: Electrical Energy. California University, Berkeley, Lawrence Hall of Science; Oak Ridge Associated Universities, TN, 34p, 1977. EDRS Price MF-$0.83. HC-$2.06 Plus Postage.

Presented is a science activities in energy package which includes 16 activities relating to electrical energy. Activities are simple, concrete experiments for fourth, fifth and sixth grades which illustrate principles and problems relating to energy. Each activity is outlined on a single card which is introduced by a question. A teacher's supplement is included.

ED 152 531 Science Activities in Energy: Conservation. California University, Berkeley, Lawrence Hall of Science; Oak Ridge Associated Universities, TN, 32p, 1977. EDRS Price MF-$0.83. HC-$2.06 Plus Postage.

Presented is a science activities in energy package which includes 14 activities relating to energy conservation. Activities are simple, concrete experiments for fourth, fifth and sixth grades, which illustrate principles and problems relating to energy. Each activity is outlined on a single card which is introduced by a question. A teacher's supplement is included.

ED 152 532 Science Activities in Energy: Solar Energy. California University, Berkeley, Lawrence Hall of Science; Oak Ridge Associated Universities, TN, 27p, 1977. EDRS Price MF-$0.83. HC-$2.06 Plus Postage.

Presented is a science activities in energy package which includes 12 activities relating to solar energy. Activities are simple, concrete experiments for fourth, fifth and sixth grades, which illustrate principles and problems relating to energy. Each activity is outlined on a single card which is introduced by a question. A teacher's supplement is included.

ED 152 773 A Teacher's Handbook on Energy. Austin, TX: Governor's Energy Advisory Council, and Texas Education Agency, 159p, 1977. EDRS Price MF-$0.83. HC-$8.69 Plus Postage.

Traditional and evolving attitudes toward energy and the compelling reasons for studying energy use and conservation are highlighted in this guide for elementary-secondary school teachers in the instruction of basic energy attitudes. Sample lessons/activities/objectives are presented from three approaches: attitude development, decision making, and action. Charts, graphs, and illustrations are provided as background material for teachers, and the loose-leaf format of the document allows for easy reproduction. An extensive bibliography of journal articles is included.

ED 153 819 Oklahoma Energy Awareness Education, Energy Education Activities, Grades K-3. Oklahoma City: Oklahoma State Dept. of Education, 176p, 1977. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication contains energy education activities for grades K through 3 and is part of a set of three publications. These activities are organized under five energy concepts: (1) energy is so basic that nothing moves without it; (2) conservation of energy; (3) there are other energy alternatives; (4) society depends on energy; and (5) the production and distribution of energy have environmental and economic consequences.

This publication is constructed in a looseleaf fashion to facilitate the reproduction of activities. Purpose, concept or objective, materials, and activity description are given for each activity. Activities involve students in games, values clarifications, and independent investigations. Activities may be selected and used in the curriculum as desired to achieve an interdisciplinary approach.

ED 153 821 Oklahoma Energy Awareness Education, Resource Materials. Oklahoma City: Oklahoma State Department of Education, 98p, 1977. EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This publication is the teacher's reference of a series of three energy education publications. This teacher's reference handbook provides background information and some materials to aid the teacher in using the activities in the other two publications. The many charts, graphs, and illustrations are designed to provide the teacher with graphic ways to assist students in understanding energy problems and concepts. The looseleaf construction of this publication will enable the teacher to remove specific pages for reproduction. Topics discussed in the twelve chapters of this publication include the energy conservation ethic, definition of energy, selected forms of energy used by man, future capital requirements for energy, and energy conservation in agriculture. Chapter 10 is a glossary of energy terms. Chapter 11 lists some selected sources of energy information.

ED 153 845 Bloch, Lenore and Others. Interdisciplinary Student/Teacher Materials in Energy, the Environment, and the Economy: 5, Community Workers and the Energy They Use, Grade 2. Washington, DC: National Science Teachers Association, 77p, 1977. (Available from—U.S. Department of Energy, Technical Information Office, P.O. Box 62, Oak Ridge, TN 37830 (no price quoted). EDRS Price MF-$0.83. HC-$4.67 Plus Postage.

This instructional unit for the second grade is intended to stimulate the child's curiosity to know more and to grasp relationships through a blending of ideas about energy with a study of the effect of the use of energy on the livelihood of people in the community. There are four lessons in the unit. The first, Introduction to Energy, deals with the question, "What is energy and energy conservation?" The second lesson, Community Workers Who Work Directly With the Sources of Energy, discusses farmers, grocers, food processors, oil workers, gas station attendants, and meter readers. The third lesson is entitled Community Workers Whose Work Depends on a Continual Supply of Energy. The fourth lesson is Community Workers Who Make Decisions About Energy. Each lesson contains complete teacher and student materials including background readings, objectives, teaching strategies, and suggestions for extending the learning outside the classroom.

ED 153 846 Bloch, Lenore and Others. Interdisciplinary Student/Teacher Materials in Energy, the Environment, and the Economy: 6, The Energy We Use, Grade 1. Washington, DC: National Science Teachers Association, 47p, 1977. (Available from—U.S. Department of Energy, Technical Information Office, P.O. Box 62, Oak Ridge, TN 37830 (no price quoted).) EDRS Price MF-$0.83. HC-$2.06 Plus Postage.

This instructional unit contains a set of nine lessons on energy for grade one. Each lesson contains complete teacher and student materials. Reading skills and language experiences are reinforced in each activity. The lessons cover such topics as energy from food, energy from the sun, fossil fuels, the wind, moving water, and energy conservation. The children examine things such as cereal grains to learn about food energy, make clay dinosaurs to get some idea about the formation time of coal, oil, and natural gas, and become part of a pinwheel parade showing the energy in wind.

ED 153 859 Johnson, Bette and Swinton, Olivia. Interdisciplinary Student/Teacher Materials in Energy, the Environment, and the Economy. Networks: How Energy Links People, Goods and Services, Grades 4, 5. Washington, DC: National Science Teachers Association, 102p, 1978. (Available from—U.S. Department of Energy, Technical Information Office, P.O. Box 62, Oak Ridge, TN 37830 (no price quoted).) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

The purpose of this unit is to investigate a simple energy network and to make an analogy with similar mutually supporting networks in the natural and man-made worlds. The lessons in this unit develop the network idea around a simple electrical distribution system that we depend on and also into further consideration of electrical energy itself. The network idea in the later lessons emphasizes the interdependence of the man-made network for producing and distributing electrical energy and the natural ecological network. In the final lesson, the consuming end of the network is examined and some strategies for consuming electrical energy are examined. Students should learn that energy networks such as the electrical circuits are a necessary part of modern life. They are also expected to learn about sources, conversions, and uses of electrical energy. There are six lessons in this fourth- and fifth-grade unit. Complete teacher and student materials are provided.

ED 153 872 Our World of Energy: An Interdisciplinary Curriculum Program for Elementary Schools. Teacher's Guide, Student Manual, 3 Filmstrips, and 3 Audio Cassette Tapes. Philadelphia Electric Co., Pennsylvania Energy Education Advisory Council. (Available from—Energy Education Advisory Council, Philadelphia Electric Co., 2301 Market Street, P.O. Box 8699, Philadelphia, PA 19101—Teacher Guide $10.00; Student Guide $1.00; Request price on quantity orders.) Document Not Available from EDRS.

This collection of instructional materials for energy education in the elementary classroom includes a teacher's guide, a student workbook, and three filmstrip/cassette-tape programs. These materials are designed to introduce children, in an interdisciplinary fashion, to energy issues and to show them what energy is, where it comes from, and what we can do about the energy crisis. The student workbook contains lessons centering on a specific topic. Each lesson begins with a section that reviews the previous one. Each lesson ends with vocabulary words, both scientific and non-scientific, the student needs to know to understand the lesson. A set of energy activities to enable the student to have hands-on laboratory experiences to clarify concepts is included. The teacher's guide contains the lessons of the student workbook plus answers, teaching suggestions and other helpful information. These materials are organized into units entitled: (1) Energy - What Is It?; (2) Energy - Where Does It Come From?; and (3) The Energy Crisis. There is one filmstrip program for each unit. The filmstrip programs reiterate the concepts of the units.

ED 156 474 Energy Education Resource Guide. Providence: Rhode Island State Department of Education, 74p, 1978. (Available from—Dissemination Unit, Rhode Island Dept. of Education, 22 Hayes Street, Providence, RI 02908—no price quoted.) EDRS Price MF-$0.83. HC-$3.50 Plus Postage.

To help fill the needs of Rhode Island teachers for useful energy education materials, the Dissemination Services Unit of this state's Department of Education has compiled this resource guide. The entries in this document are available either from ERIC or from the Dissemination Services Unit; ED numbers are given for ERIC documents. For all entries, a brief description along with the title and author information are given. The publication lists documents that may be of use in general energy education by grade levels: (1) elementary, (2) secondary, and (3) K-12. Selected journal articles are included along with a resources section including films, periodicals, organizations, and Rhode Island Resources entries. The 120-plus documents entered cover many aspects of the energy dilemma including economics, natural resource allocation and use, federal energy policy, nuclear power, and possible solutions to the problems. Some emphasis is given to the energy situation in Rhode Island, but this resource guide should be useful to educators nationwide.

ED 157 681 Tully, Randolph R., Jr., Ed. A Curriculum Activities Guide to Electric Power Generation and the Environment. Blue Bell, PA: Project KARE, 154p, 1975. (Available from Project KARE, Colony Office Building, Route 73 and Butler Pike, Blue Bell, PA 19422; no price quoted.) EDRS Price MF-$0.83 Plus Postage. HC-$8.69 Plus Postage.

This guide was developed by teachers involved in a workshop on "Electric Power Generation and the Environment." Activity topics are: (1) Energy and the Consumer, (2) Energy and Water Pollution, and (3) Energy and Air Pollution. Within these topics, the activities are classified as awareness level, transitional level, or operational level. Each activity contains an introduction, questions, equipment list, and procedure. There are over 70 activities for students in grades 1-12. The appendix provides a brief description of the development of the learning activities in this guide.

ED 157 782 Wert, Jonathan M., and Worthington, Barry K. ENERGY: Selected Resource Materials for Developing Energy Education/Conservation Programs. Revised Edition. University Park, PA: Pennsylvania State University, College of Agriculture, 34p, 1978. (Available from National Wildlife Federation, 1412 Sixteenth Street, NW, Washington, DC 20036; single copies free.) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This annotated bibliography presents resource materials for energy education programs. The materials are listed by the agency from which they are available. The agencies are alphabetized and, for each agency, a mailing address is given. Fifty agencies are included, many of which have several references listed. For each reference, title, author, and publication date are given, along with a four to five-line annotation which describes the contents of the reference and possible uses. Some references also include number of pages and prices. The references in this bibliography were selected to be useful to those involved in developing or implementing an energy education or energy conservation program either in the schools or in community groups. The variety of references includes teaching guides, curriculum development guides, learning activities, energy education units, "how-to-do-it" materials for solar power projects, and consumer awareness publications.

ED 159 022 Carey, Helen H., Ed. Award Winning Energy Education Activities for Elementary and High School Teachers. Washington, DC: National Science Teachers Association, 52p, 1977. (Available from U.S. Department of Energy, Technical Information Office, P.O. Box 62, Oak Ridge, TN; no price quoted.) EDRS Price MF-$0.83 Plus Postage. HC-$3.50 Plus Postage.

This publication contains descriptions of the winning entries to the National Science Teachers Association Participation Contest in 1976. This was a nationwide contest for the design of activities around energy themes at any grade level, K-12. The ten winning entries described here are: (1) Energy Units for Primary Grades; (2) Aluminum Recycling Experiment; (3) Energy in Art and Energy is All Around Us; (4) Black Gold; (5) Energy, Economy, Education; (6) Local Investigation in Container Use; (7) Kill A Watt; (8) Idea: Designing an Energy-

Efficiency House; (9) Solar Heating and Cooling; and (10) Living with Wind Power. Many of these winners are designed for the senior high school. Each one has included a brief summary of what the activity teaches, what the students do, and how the activity might fit into the existing curriculum.

ED 159 042 Jones, John, and Dalton, Edward. The Energy and Environment Glossary, 1977. Portland, OR: Energy and Man's Environment, 50p, 1977. (Available from Energy and Man's Environment, 0223 S.W. Hamilton, Suite 301, Portland, OR 97201; $4.00.) EDRS Price MF-$0.83 Plus Postage. HC-$2.06 Plus Postage.

This is a glossary of words that commonly appear in energy education and environmental education materials. With over 750 words ranging from "abatement" to "zooplankton," this publication includes such uncommon terms as "anadramous," "film badge," "putrescible," and "tritium." Space is provided after each alphabetical section for the addition of words not included in the publication. The publication seems to have been written for use by upper elementary and junior high school students. The definitions are non-technical and, where appropriate, include comments on how the term relates to environmental issues. This glossary should also be useful to teachers.

ED 160 418 Gerlovich, Jack A. Energy Concepts in the Iowa School Curriculum. Des Moines, IA: Iowa State Department of Public Instruction, 32p, 1978. EDRS Price MF-$0.83 Plus Postage. HC-$2.06 Plus Postage.

This document reports on the Iowa Department of Public Instruction Plan to integrate energy education into elementary and secondary programs. This plan includes the development of energy conservation activity packets. The packets contain a variety of interdisciplinary activities, accompanying worksheets, visuals, and annotated children and teacher bibliographies for grades K-6. Also included in the plan is the Mankato State University Energy Program, which is designed to acquaint teachers with some classroom projects that can be done by students in grades 7-12, and give teachers an extended classroom project in which students evaluate the energy consumption of their school. Finally, this report presents the results of a questionnaire designed to assess the present energy programs and perceived energy needs of Iowa secondary school teachers. The dominant concerns of the teachers surveyed were energy conservation and the political and social aspects of energy problems.

ED 160 439 Energy Education Materials Inventory, Volume I: An Annotated Bibliography of Currently Available Materials, K-12, Published Prior to May, 1976. Houston, TX: University of Houston Energy Institute, 301p, 1978. (Available from National Technical Information Service, U.S. Department of Commerce, 5825 Port Royal Road, Springfield, VA 22161; MF-$3.00, HC-$11.75.) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication is a systematic listing of energy education materials and reference sources suitable for use in elementary and secondary schools. Items in this volume, located through computer searches, were still available in May, 1978. This inventory of energy resource materials consists of three indexes: media, grade level, and subject. Each major part is divided into sections and citations are alphabetically listed in each section. Media is divided into: (1) Audiovisual; (2) Books; (3) Instructional Materials; (4) Activities; and (5) Reference Sources. Grade level is sectioned into: (1) Kindergarten; (2) Primary; (3) Elementary; (4) Intermediate; (5) Secondary; and (6) Special Education. Subject is divided into the following sections: (1) Alternative Energy Sources; (2) Biology, Chemistry, Physics, and General Science; (3) Energy Conservation, Consumption, and Utilization; (4) Environmental-Social Aspects of Energy Technology; (5) Fossil Fuels; (6) Materials; and (7) Policy and Legislation. Approximately 800 items are included in the resource list.

ED 161 727 Energy Conservation Activities for the Classroom, K-12. Frankfort, KY: Kentucky Department of Energy, Kentucky Department of Education, 244p, 1978. EDRS Price MF-$0.83 Plus Postage. HC-$12.71 Plus Postage.

After a brief introduction entitled "Where Does the Energy We Use Come From," this unit presents 86 activities. Each activity gives the title, concept, objectives, subject area, level, time involved, materials needed, procedures, and related career activities. Topics cover everything from housing insulation to alternate sources of energy to energy use by appliances and automobiles. The activities include game playing, science experiments, surveys, field trips, and others. The unit concludes with a bibliography.

ED 162 886 An Educator's Introduction to Energy Concepts: Overview Packets. Falmouth, ME: Maine Audubon Society, 68p, 1977. EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This publication provides a broad overview of energy and related issues for teachers and others who want to improve their understanding of these issues. Included in this publication are discussions of: (1) elementary physics related to energy; (2) energy sources, including topics such as renewable and non-renewable resources and fossil fuels; (3) energy uses in the U.S.; (4) thermodynamics; (5) space heating; (6) energy conservation; and (7) socioeconomic aspects of the energy crisis. The last section entitled Consumption/Life Style is designed for social science teachers and discusses the effects of population increases on natural resources and social values. Diagrams and tables are provided to illustrate, among other things: (1) energy consumption rates of various electric appliances; (2) energy uses by economic sector; (3) U.S. energy flow from source to work and waste; and (4) the flow of energy to and from earth.

ED 162 900 Energy Education Materials Bibliography. St. Paul: Minnesota State Energy Agency, 65p, 1978. EDRS Price MF-$0.83 Plus Postage. HC-$3.50 Plus Postage.

This is an annotated bibliography of selected energy education materials. The materials included in this document are indexed according to grade level and according to whether they are background materials or classroom activities. Each of the 100 items listed were evaluated and included into either the "A" list or the "B" list. The "A" list contains activities and background materials that were judged to be somewhat better by virtue of: (1) content included; (2) activities; (3) ease of use; (4) background material; and/or (5) reference provided. The "B" list contains activities and background materials which cover a wider range of subjects and approaches and may be used as the core of or as supplements to energy units. In addition to the usual bibliographic information, such as title, author, publisher/source. other information included is: (1) suggested grade levels; (2) suggested subject areas; (3) media type; (4) cost and date issued; (5) types of activities; (6) energy topics; (7) approaches; (8) student outcomes; (9) what teacher background is assumed; and (10) general comments. Also indicated is whether materials are designed for use by students, teachers or both.

ED 162 912 Energy: An Annotated Bibliography of Selected Energy Education Materials. Lincoln, MA: Massachusetts Audubon Society, Hatheway Environmental Education Institute, 64p, 1977. EDRS Price MF-$0.83 Plus Postage. HC-$3.50 Plus Postage.

This is an annotated bibliography of selected energy education materials. These materials were selected according to the following criteria: (1) Usability in an instructional atmosphere; (2) Relevancy to issues on energy use in the environment; (3) Accuracy and current relevancy of energy facts and trends; (4) Attractiveness of format including organization; (5) Emphasis on energy conservation and quality of life; and (6) Emphasis on student involvement in classroom or community activities. A coding system is used for cross-referencing and for indicating grade level and conceptual area for which an entry is appropriate. A variety of different types of materials including: (1) bibliographies; (2) pamphlets; (3) books; (4) periodicals and articles; (5) teaching guides; and (6) audiovisual materials and simulations, are annotated in this bibliography.

ED 164 299 The Energy Primer. Chattanooga, TN: Tennessee Valley Authority, Division of Power Utilization, 47p, 1976. EDRS Price MF-$0.83 Plus Postage. HC-$2.06 Plus Postage.

This publication is an information source on energy for teachers. The information in this publication is factual, and designed for courses of study about energy. This book

has been divided into separate energy-related sections. Each section ends with a list of student participation discussion activities. The sections present facts about: (1) energy and its use; (2) oil and natural gas; (3) coal and hydropower; (4) nuclear energy; (5) energy used for transportation; (6) future energy sources; (7) electrical power sources in the TVA area; and (8) energy conservation. A glossary of terms is also provided. This publication was designed as a teacher's resource, not as a curriculum guide. The activities suggested are more appropriate for junior and senior high school students.

ED 165 988 Priddy, Michael D., Ed., and Others. Energy Conservation Education Resource Guide. Greensboro, NC: Guilford County School System, 175p, 1978. EDRS Price MF-$0.83 Plus Postage. HC-$8.69 Plus Postage.

This publication presents the activities pertaining to the second goal of this activity guide series. The activities in this publication focus primarily on awareness, conservation and planning. These materials are appropriate for middle school and junior high school students. These activities, organized by objective under the concepts listed, are interdisciplinary and can be used in many ways. The activities are simply ideas of things that students can do to help them understand the concepts. It has been left for the teacher to choose and implement these ideas as desired. Activities range from writing a story that details the impact on members of a food chain when one member is removed to conducting a community survey to determine how people are trying to conserve energy.

ED 166 032 Elvin, Betty, and Others. Texas Energy Education Framework: A Pilot Draft. Austin, TX: Texas Education Agency, 28p, 1978. EDRS Price MF-$0.83 Plus Postage. HC-$2.06 Plus Postage.

This publication presents a conceptual framework for grades K through 12 energy education in Texas. Matrices are used in which "basic concerns of people" such as: (1) individual well-being; (2) career; and (3) social interactions are given on one axis and three learning dimensions: (1) knowledge; (2) applications; and (3) values are used on the other axis. These matrices are to serve as a guide to curriculum development and are given for grade levels K-3, 4-6, 6-8, and 9-12. Energy education experiences are given for parts of these matrices. Infusing energy education into existing curricula is expanded and a rationale for energy education is given.

ED 166 067 Rinehart, Milton, Comp., and Others. Energy Education: A Bibliography of Abstracts from "Resources in Education (RIE)" from 1966-1978. Columbus, OH: Information Reference Center

for Science, Mathematics, and Environmental Education, 159p, 1979. (Available from Information Reference Center, The Ohio State University, 1200 Chambers Road, 3rd Floor, Columbus, OH 43212; $5.50.) EDRS Price MF-$0.83 Plus Postage. HC Not Available from EDRS.

This is a compilation of abstracts from "Resources in Education" for publications relating to energy education. The publications announced relate to energy education by being: (1) instructional materials such as teaching activity guides; (2) teacher resource guides; (3) information sources on energy resources; or (4) school building conservation materials. Information given for each entry includes: (1) ERIC and clearinghouse accession numbers; (2) title; (3) author; (4) descriptors; (5) EDRS price; (6) abstract; and (7) institution or sponsoring agency name. The abstracts are descriptive paragraphs which indicate the contents of each publication. Over 500 publications are included in this bibliography. Subject, author, and institutional author indices are included to aid the user in locating a particular publication in this bibliography.